FAA-STD-029d

December 22, 1995

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Standard

Selection and Implementation

of

Telecommunications Standards

FOREWORD

This document lists the telecommunications (voice and data) standards used by the Federal Aviation Administration (FAA) when ordering or selecting new telecommunications equipment/systems. This standard also will also serve as a reference document for the FAA telecommunications program, but is not intended to be a referenced document in a procurement package.

The selection of the appropriate standards referenced within this document for inclusion in specific procurement packages is to be accomplished in the following manner:

- a. Identify the telecommunications interfaces addressed within the procurement action and the existing telecommunications interfaces that are impacted by the procurement.
- b. Consult FAA-STD-029, section 3, and identify within the constraints imposed by the existing equipment, the applicable standards. If additional clarification is necessary, refer to the selection and application criteria contained in Appendix I.
- c. Examine in detail each potentially appropriate standard and select the ones that best define the interface requirements.
- d. Extract the appropriate technical requirements portion of the solicitation wording for inclusion in the procurement package.

Prior to implementation, verify that the telecommunications interfaces defined by the standards listed in FAA-STD-029 are compatible with existing interfaces.

CONTENTS

CONTENTS (cont'd)

1. SCOPE

1.1 Scope. This document list the provides telecommunications standards to be used by the Federal Aviation Administration (FAA) in the preparation of specifications and related procurement documents, which are used when considering the lease or purchase of telecommunications systems, services, or equipment.

1.2 Purpose. This document is to be used by FAA personnel in the selection of telecommunications standards for FAA projects. This standard will not be used as a referenced document in a procurement request package.

2. APPLICABLE DOCUMENTS

2.1 Government documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal, are considered a part of the standard to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this standard, the contents of the referenced document shall be considered the superseding requirement.

FAA Documentation

FAA-E-FAATSAT	FAA Telecommunicationss Satellite System
FAA Order 1830.7	Fiber Optic Transmission Systems and Equipment Policy
FAA Order 1830.2C	Telecommunications Standardss Selection and Implementation Policy

STANDARDS:

FAA

FAA-STD-039	National Airspace System (NAS) Open Systems Architecture and Protocols
FAA-STD-049	Fiber Optic Telecommunication Systemss and Equipment

Federal

FED-STD-1002	Time and Frequency Reference Information in Telecommunication Systems
FED-STD-1005	Coding and Modulation Requirements for 2400 Bit/Second Modems
FED-STD-1006	Coding and Modulation Requirements

	for 4800 Bit/Second Modems
FED-STD-1007	Coding and Modulation Requirements for Duplex 9600 Bit/Second Modems
FED-STD-1008	Coding and Modulation Requirements for Duplex 600 And 1200 Bit/Second Modems
FED-STD-1010/FIPS PUB 16-1	Bit Sequencing of the American National Standard Code for Information Interchange in Serial-By-Bit Data Transmission
FED-STD-1011/FIPS PUB 17-1	Character Structure and Character Parity Sense for Serial-By-Bit Data Communication in the Code for Information Interchange
FED-STD-1012/FIPS PUB 18-1	Character Structure and Character Parity Sense for Parallel-by-Bit Data Communication in the American National Standard Code for Information Interchange
FED-STD-1013/FIPS PUB 22-1	Synchronous Signaling Rates Between Data Terminal Equipment and Data Circuit-Terminating Equipment Utilizing 4kHz Circuits
FED-STD-1015	Analog to Digital Conversion of Voice by 2,400 Bit/Second Linear Predictive Coding
FED-STD-1020	Electrical Characteristics Of Balanced Voltage Digital Interface Circuits
FED-STD-1026	Interoperability and Security Requirements For Use of the Data Encryption Standard in the Physical Layer of Data Communications
FED-STD-1027	General Security Requirements for Equipment Using the Data Encryption Standard
FED-STD-1030	Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits
FED-STD-1032/FIPS PUB 154	High Speed 25-Position Interface for Data Terminal Equipment And Data Circuit-terminating Equipment
FED-STD-1033	Data Communications Systems and Service-User Oriented Performance

	Parameters
FED-STD-1037	Glossary of Telecommunications Terms

National Institute for Standards and Technology (NIST)

FIPS PUB 1-2	Code for Information Interchange, its Representations, Subsets, and Extensions
FIPS PUB 16-1/FED-STD-1010	Bit Sequencing of the Code for Information Interchange in Serial-by-Bit Data Transmission
FIPS PUB 17-1/FED-STD-1011	Character Structure and Character Parity Sense for Serial-by-Bit Data Communication in the Code for Information Interchange
FIPS PUB 18-1/FED-STD-1012	Character Structure and Character Parity Sense for Parallel-by-Bit Data Communication in the Code for Information Interchange
FIPS PUB 22-1/FED-STD-1013	Synchronous Signaling Rates Between Data Terminal and Data Communication Equipment
FIPS PUB 46	Data Encryption Standard
FIPS PUB 58-1	Representation of Local Time of the Day for Information Interchange
FIPS PUB 59	Representation of Universal Time, Local Time Differentials and United States Time Zone References for Information Interchange
FIPS PUB 81	Data Encryption Standard (DES) Modes of Operations
FIPS PUB 86	Additional Controls for Use with American National Standard Code for Information Interchange
FIPS PUB 107	Local Area Networks: Baseband Carrier Sense Multiple Access with Collision Detection Access Method and Physical Layer Specifications and Link Layer Protocol
FIPS PUB 154	High Speed 25-Position

	Interface for Data Terminal Equipment And Data Circuit-terminating Equipment
FIPS PUB 182	Integrated Servicess Digital Network (ISDN)
NIST Special Publication 500-195	North American ISDN Users' Forum Agreements on Integrated Services Digital Network

National Communications Security Committee

NCSC-11	National Policy for Protection of Telecommunications Systems Handling Unclassified National Security Information

Federal Communications Commission (FCC)

FCC Rules and Regulations, part 68	Connection of Terminal Equipment to the Telephone Network

Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement functions should be obtained from the procuring activity or as directed by the contracting officer.

2.2 Non-Government documents. The following documents form a part of the standard to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this standard, the contents of the referenced document shall be considered the superseding requirement.

STANDARDS:

Bellcore (Bell Communications Research) Publications

PUB 41008	Transmission Parameters Affecting Voiceband Data Transmission Description of Parameters
PUB 43004	Functional Criteria -Voice Frequency Network Channel Terminating Equipment 4-Wire Maintenance Terminating Unit
PUB 43101	Voice Grade Entrance Facilities for Extending Customer - Provided Communications Channels
PUB 43201	Private Line Interconnection Voice Applications

PUB 43701	Private Line Interconnection - Connection to a Channel of a Communications System
PUB 43720	Private Line Interconnection - Operational Features of Bell System Switch Terminations
PUB 43801	Digital Channel Bank - Requirements and Objectives
PUB 43804	Network Terminal Equipment Operations Interface Specification
PUB 62103	High Performance Data Conditioning - Type D5 for Multi-Point Private Line Data Channels
PUB 62113	Network Channel Interface Specifications for Off-Premises Station Lines (PBX End) Facility Interface Codes OL13A, OL13B, and OL13
PUB 62114	Network Channel Interface Specifications for Tie Trunk-like Channel's Accumulating Four Wire Lossless Registered Terminal Equipment That Originates on M-Lead Facility Interface Codes TL31M and TL32M
PUB 62115	Network Channel Interface Specifications for Tie Trunk-like Channel's Accumulating Four Wire Lossless Registered Terminal Equipment That Originates on E-Lead Facility Interface Codes TL31E and TL32E
PUB 62200	Group and Super Group Spectra + Description and Interface Specification
PUB 62310	Digital Data System Channel Interface Specification
PUB 62411	High Capacity Digital Service Channel Interface Specification Preliminary

BELLCORE Technical References

TA-NPL-000342	High-capacity Digital Special

	Access Service Transmission Parameter Limits and Interface Combinations
TR-NPL-000334	Voice Grade Switched Access Service Transmission Parameter Limits and Interface Combinations
TR-NPL-000335	Voice Grade Special Access Service Transmission Parameter Limits and Interface Combinations
TR-NPL-0000336	Metallic and Telegraph Grade Special Access Service Transmission Parameter Limits and Interface Combinations
TR-NPL-000337	Program Audio Special Access Service Transmission Parameter Limits and Interface Combinations
TR-NPL-000338	Television Special Access and Local Channel Services - Transmission Parameter Limits and Interface Combinations
TR-NPL-000339	Wideband Analog Special Access Service Transmission Parameter Limits and Interface Combinations
TR-NPL-000340	Wideband Data Special Access Service Transmission Parameter Limits and Interface Combinations
TR-NPL-000341	Digital Data Special Access Service Transmission Parameter Limits and Interface Combinations
TR-NPL-000342	High-capacity Digital Special Access Service Transmission Parameter Limits and Interface Combinations
TR-TSY-000007	Voice Frequency Network Channel Terminating Equipment - Metallic Facilities
TR-TSY-000009	Asynchronous Digital Multiplexes - Requirements and Objectives
TR-TSY-000475	Operations Technology Generic Requirements (OTGR): Network Maintenance Transport Surveillance, Section 5

American National Standards Institute (ANSI)

ANSI.T1.102-1990	Digital Hierarchy - Format Specifications
ANSI.T1.107-1988	Digital Hierarchy - Electrical Interface
ANSI.T1.408-1990	Telecommunications - Integrated Services Digital Network (ISDN) - Primary Rate - Customer Installation Metallic Interfaces - Layer 1 Specifications
ANSI.T1.408-1990	Telecommunications - Integrated Installa tion Metallic Interfaces - Layer 1
ANSI.T1.602-1989	Telecommunicationss - Integrated Services Digital Network (ISDN) - Data Link Layer Signaling Specification for Application at the User-Network Interface
ANSI.T1.603-1990	Telecommunicationss - Integrated the Primary Rate Interface. Services Digital Network (ISDN) - Minimal Set of Bearer Services for the Primary Rate Interface.
ANSI.T1.607-1990	Telecommunicationss - Integrated Services Digital Network (ISDN) - Digital Subscriber Signaling System Number 1 (DSS1) - Signaling Specification for Circuit Switched Bearer Service.
ANSI.T1.615-1990	Telecommunicationss - Digital Subscriber Signaling System No. 1 (DSS) 1 - Layer 3 Overview

Institute of Electrical and Electronic Engineers (IEEE)

IEEE-STD-743	Standard Methods and Equipment for Measuring the Transmission Characteristics of Analog Voice Frequency Circuits.
IEEE-802.3	Local Area Networks Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

International Civil Aviation Organization (ICAO)

Annex 10, Volume I and II	Aeronautical Telecommunications

International Organization for Standardization (ISO)

ISO 2110:1989	Information Technology - Data Communication- 25-Pin Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) Interface Connector and Contact Number Assignments, 3rd Edition
ISO 3309:1991	Information Processing Systems - Data Communication - High-Level Data Link Control Procedures - Frame Structure, 4th Edition
ISO 4335:1987	Information Processing Systems - Data Communication - High-level Data Link Control Elements of Procedures, 3rd Edition
ISO 7498:1984	Information Processing Systems - Open Systems Interconnection- Part 1: Basic Reference Model, 1st Edition
ISO 7809:1984	Information Processing Systems - Data Communication - High-level Data Link Control Procedures - Consolidation of Classes of Procedures, 1st Edition

International Telephone and Telegraph Consultative Committee (CCITT)

CCITT V.24	List of Definitions for Interchange Circuits Between Data Terminal Equipment and Data Circuit-Terminating Equipment
CCITT V.28	Electrical Characteristics for Unbalanced Double-Current Interchange Circuits

Electronic Industries Association (EIA)

RS-232C	Interface Between Data Terminal Equipment and Data

	Circuit-Terminating Equipment Employing Serial Binary Data Interchange
EIA-232D/E	Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
EIA-422 and Appendix	Electrical Characteristics of Balanced Voltage Digital Interface Circuits
EIA-423 and Appendix	Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits
EIA-464	Private Branch Exchange (PBX) Switching Equipment for Voice Bank Applications
EIA-470	Telephone Instruments, with Loop SignalingSignalling for Voice Band Applications
EIA-496	Interface Between Data Circuit Equipment (DCE) and the Public Switched Telephone Network (PSTN)
EIA-530	High Speed 25-Position Interface for Data Terminal Equipment and Data Circuit Terminating Equipment

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using federal agencies.

3. REQUIREMENTS

3.1 General. The FAA telecommunication standards activity covered by this document is a result of standardization efforts taking place external to the agency. The standards appropriate to FAA systems, services, and equipment have been selected from data, voice, and transmission standards developed or implemented by the following organizations or groups: American National Standards Institute (ANSI), General Services Administration (GSA), International Organization for Standardization (ISO), International Telephone and Telegraph Consultive Committee (CCITT) [renamed International Telecommunication Union - Telecommunications Standardization Sector (ITU-T)], National Institute of Standards and Technology (NIST), American Telephone and Telegraph (AT&T), Electronic Industry Association (EIA), Federal Communications Commission (FCC), Institute of Electrical and Electronic Engineers (IEEE), Bell Communications Research (Bellcore), and the International Civil Aviation Organization (ICAO). A Federal Information Processing Standard Publication (FIPS PUB) may

reference a technical standard adopted by ANSI. A Federal Standard (FED-STD) refers to a technical standard adopted by the Federal Telecommunications Standards Program. Careful selection and application of these standards will allow agency systems to evolve more efficient interfaces as well as meet transition and interoperability requirements. The FAA telecommunications standards activity must therefore be tightly controlled during the planning and upgrading process for National Airspace System (NAS) and agency support systems identified in the Information Resource Management Plan. The standards selected for the FAA are from three categories:

a. Mandatory standards are those imposed by a U.S. authority on government systems and equipment. The FAA is required to use mandatory standards to meet its requirements. However, imposing mandatory standards does not preclude the FAA from 1. applying its own standards or other voluntary standards to satisfy a particular requirement if there is not an equivalent "Federal" standard available.

b. Treaty standards are international standards such as those imposed by CCITT, ICAO, or regulatory bodies.

c. Voluntary Standards are standards which are highly desirable for interoperability and system cost avoidance purposes. Certain voluntary standards, such as those agreed to by EIA and others, have been, or soon may be, adopted as mandatory by the U.S. Government.

3.2 Data communications. This subsection details the basic information necessary to describe relevant communications standards. Information is provided concerning the purpose of the document, its applicability, provisions for waivers, and technical requirements portion of the solicitation wording. A description in summary form of the features or parameters of the data communications standards, selection criteria, and an inventory of essential technical characteristics of each standard are included where appropriate.

3.2.1 Parameters and selection criteria.

3.2.1.1 Interchange codes and data storage media.

3.2.1.1.1 FIPS PUB 1-2: Code for Information Interchange, Its Representations, Subsets, and Extensions. FIPS PUB 1-2 is a mandatory standard and shall be used to promulgate ASCII code and specifies the code and character set for use in Federal information processing systems, communications systems, and associated equipment.

3.2.1.1.1.1 Applicability. The standard shall be applicable to all computer and related equipment configurations brought into the federal inventory, acquired or leased with federal funds. It also applies to data systems developed at government expense, if such data is to be a part of the data base of a federal agency. "Related equipment" includes all character-oriented equipment in which magnetic tape, perforated tape, or flexible disk is

produced for input to a computer-based data system or received as output from a computer based data system.

3.2.1.1.1.2 Waivers. Waivers to this standard shall be obtained from the administrator.

3.2.1.1.1.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "The system, upon receiving a hardware or software command, shall accept data on magnetic tape, paper tape, or any other input media covered by an approved FIPS PUB in ASCII code and collating sequence prescribed in FIPS PUB 1-2 and in the format prescribed in FIPS PUBS 2-1, 3-1, 25, 50, or other applicable FIPS PUBs. Such data shall be translated, if necessary, into a form that the proposed equipment can internally process, provided that, upon receiving a hardware or software command, the proposed equipment can produce processed data on magnetic tape, paper tape, and other output media in the ASCII code and collating sequence prescribed in FIPS PUB 1-2 and in the format prescribed in FIPS PUBs 2-1, 3-1, 25, 50, or other applicable FIPS PUBs."

3.2.1.1.2 Deleted.

3.2.1.1.3 Deleted.

3.2.1.1.4 Deleted.

3.2.1.1.5 Deleted.

3.2.1.1.6 Deleted.

3.2.1.1.7 FIPS PUB 86: Additional Controls for Use with American National Standard Code for Information Interchange. FIPS PUB 86 is a mandatory standard and shall be used to specify a set of encoded control functions to facilitate data interchange between Automated Data Processing (ADP)/data communication equipment and two-dimensional character-imagining I/O devices. These control functions augment the basic set of control functions prescribed by FIPS PUB 1-2.

3.2.1.1.7.1 Applicability. The standard shall be applicable to all ADP equipment and services that involve character imaging and which employ the character set and encoding conventions prescribed by FIPS PUB 1-2.

3.2.1.1.7.2 Waivers. Waivers to this standard shall be obtained from the Secretary of Commerce via the administrator.

3.2.1.1.7.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All applicable ADP character-imaging equipment or services (e.g., interactive ADP terminals of the display and printer type, line printers, microfilm printers, typesetting composers, word processors, and related devices or services using such devices) offered as a result of the requirements of which this is a part

shall comply with the requirements set forth in FIPS PUB 86 when such equipment or services employ the character set and encoding conventions prescribed in FIPS PUB 1-2. All ADP terminals that meet these conditions are included in this requirement if they contain alphanumeric keyboards and CRT displays or printers that may be used in any form of on-line interactive application or stand-alone off-line data preparation. Computer resident control software may be used, but is not required, to implement specific features of FIPS PUB 86, unless specified otherwise in this document."

3.2.1.2 Data Transmission.

3.2.1.2.1 FIPS PUB 16-1: Bit Sequencing of the Code for Information Interchange in Serial-by-bit Data Transmission. FIPS PUB 16-1 is a mandatory standard and shall be used to specify the method of transmitting ASCII code. FIPS PUB 16-1 is a joint standard with FED-STD-1010.

3.2.1.2.1.1 Applicability. The standard shall be applicable to equipment or services transmitting an approved Standard Code in a serial-by-bit, serial-by-character stream form at the interface between data terminal equipment and data communications equipment.

3.2.1.2.1.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.2.1.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All applicable equipment or services that may result from this solicitation, transmitting in a serial-by-bit, serial-by-character mode, shall be capable of bit sequencing as prescribed in FIPS PUB 16-1/FED-STD-1010 for the transmission of the Standard Code for Information Interchange, FIPS PUB 1-2, at the interface between data terminal equipment and data communication equipment."

3.2.1.2.2 FIPS PUB 17-1: Character Structure and Character Parity Sense for Serial-by-bit Data Communication in the Code for Information Interchange. FIPS PUB 17-1 is a mandatory standard and shall be used to specify the method of transmitting ASCII code, FIPS PUB 1-2, in the serial-by-bit, serial-by-character data transmission. FIPS PUB 17-1 is a joint standard with FED-STD-1011.

3.2.1.2.2.1 Applicability. The standard shall be applicable to equipment or services transmitting ASCII code (FIPS PUB 1-2) in a serial-by-bit, serial-by-character synchronous or asynchronous mode.

3.2.1.2.2.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via administrator.

3.2.1.2.2.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All applicable equipment that may result from this solicitation, transmitting in a serial-by-bit, serial-by-character synchronous or

asynchronous mode, shall be capable of transmitting the character structure and sense of character parity prescribed in FIPS PUB 17-1/FED-STD-1011 for the transmission of the Standard Code for Information Interchange, FIPS PUB 1-2, at the interface between data terminal equipment and data communication equipment."

3.2.1.2.3 FIPS PUB 18-1: Character Structure and Character Parity Sense for Parallel-by-bit Data Communication in the Code for Information Interchange. FIPS PUB 18-1 is a mandatory standard and shall be used to specify the channel assignment for transmitting the Standard Code for Information interchange, FIPS PUB 1-2, in parallel-by-bit, serial-by-character data transmission. FIPS PUB 18-1 is a joint standard with FED-STD-1012.

3.2.1.2.3.1 Applicability. The standard shall be applicable to equipment or services transmitting ASCII code (FIPS PUB 1-2) in a parallel-by-bit, serial-by-character mode.

3.2.1.2.3.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via administrator.

3.2.1.2.3.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All applicable equipment or services that may result from this solicitation, transmitting in a parallel-by-bit, serial-by-character mode, shall be capable of transmitting the character structure and sense of character parity prescribed in FIPS PUB 18-1/FED-STD-1012, when transmitting the Standard Code for Information Interchange, FIPS PUB 1-2, at the interface between data terminal equipment and data communication equipment."

3.2.1.2.4 FIPS PUB 22-1: Synchronous Signaling Rates between Data Terminal and Data Communication Equipment. FIPS PUB 22-1 is a mandatory standard and shall be used to specify the rates of transferring binary encoded information in synchronous serial or parallel form between data processing terminal and data communication equipment that employ voice grade communication facilities. FIPS PUB 22-1 is a joint standard with FED-STD-1013.

3.2.1.2.4.1 Applicability. The standard shall be applicable to equipment and services used in connection with synchronous data communication equipment operating on binary encoded information in serial or parallel fashion over voice grade communication channels of nominal 4 kilohertz (kHz) bandwidth.

3.2.1.2.4.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator

3.2.1.2.4.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All applicable equipment or services resulting from this solicitation that are employed in conjunction with synchronous data communication equipment designed to operate on binary encoded information in either serial or parallel

fashion over voice grade communication channels of nominal 4kHz bandwidth shall comply with FIPS PUB 22-1/FED-STD-1013."

3.2.1.2.5 EIA-232E: Low Speed 25-Pin Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment. EIA-232E is a revision of RS-232C and EIA-232D, which brings it in-line with international standards CCITT V.24, V.28, and ISO 2110. It also includes the specification for a 25-pin interface connector and adds local loopback, remote loopback, and test mode interchange circuits. A shield has been added, the protective ground has been redefined, and some terminology has been changed.

EIA-232E may be used to specify the interconnection of data communication of data terminal equipment (DTE) and data circuit-terminating equipment (DCE) employing serial binary data interchange over unbalanced voltage digital interface circuits. This standard defines the signal characteristics, interface mechanical characteristics, functional description of interchange circuits, and standard interfaces for selected communication system configurations. EIA-232E is compatible with the electrical characteristics of EIA-232D, but not with EIA-530. EIA-232E is compatible with the electrical characteristics of RS-232C, but has additional functionality.

3.2.1.2.5.1 Applicability. This standard shall be applicable for communications equipment with applications requiring use of dial-up or secondary signals and employing low speed (zero to 20,000 bits per second) interchange between DTEs and DCEs.

3.2.1.2.5.2 Waiver. Not applicable.

3.2.1.2.5.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All telecommunication equipment, with applications requiring use of either dial-up or secondary signals and using zero to 20,000 bits per second interchange between DCEs and DTEs, that is offered as a result of this solicitation shall comply with the electrical, mechanical, and functional characteristics addressed by EIA-232D."

3.2.1.2.6 Deleted.

3.2.1.2.7 FIPS PUB 107: Local Area Networks: Baseband Carrier Sense Multiple Access with Collision Detection Access Method and Physical Layer Specifications and Link Layer Protocol. FIPS PUB 107 is a mandatory standard and shall be used to provide the mechanical, electrical, functional and procedural specifications and the link protocol required to establish physical connections, to transmit bits and to send data link frames between nodes.

3.2.1.2.7.1 Applicability. The standard shall be applicable to all federal departments and agencies which require compatibility with voluntary industry standards for both public and private data communications networks.

3.2.1.2.7.2 Waivers. Waivers to this standard shall be obtained from the administrator.

3.2.1.2.7.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All local area network (LAN) services and equipment employing CSMA/CD (IEEE STD 802.3) which result from this requirement shall provide the capability to transmit bits and to send data link frames between nodes in compliance with the requirements set forth in FIPS PUB 107."

3.2.1.2.8 Deleted.

3.2.1.2.9 FED-STD-1005: Coding and Modulation Requirements for 2400 Bit/Second Modems. FED-STD-1005 is a mandatory standard and shall be used to establish the coding and modulation requirements for 2400 bit/second modems owned or leased by the federal government for use over analog transmission channels other than those derived from high-frequency radio facilities.

3.2.1.2.9.1 Applicability. The standard shall be applicable to 2400 bit/second modems for use with nominal 4kHz channels derived from either switched networks or dedicated lines. It provides for split channel (full duplex) operation on switched circuits.

3.2.1.2.9.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.2.9.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All 2400 bits/second modems that are offered as a result of this solicitation for use with 4kHz channels derived from either switched networks or dedicated lines shall comply with FED-STD-1005."

3.2.1.2.10 FED-STD-1006: Coding and Modulation Requirements for 4800 Bit/Second Modems. FED-STD-1006 is a mandatory standard and shall be used to establish the coding and modulation requirements for 4800 bits/second modems owned or leased by the federal government for use over analog transmission channels.

3.2.1.2.10.1 Applicability. The standard shall be applicable to 4800 bits/second modems (and equipment containing modems) for use with nominal 4kHz analog channels.

3.2.1.2.10.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.2.10.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All 4800 bits/second modems (and equipment containing 4800 bits/second modems) offered as result of this solicitation for use with nominal 4kHz analog channels shall comply with FED-STD-1006."

3.2.1.2.11 FED-STD-1007: Coding and Modulation Requirements for Duplex 9600 Bit/Second Modems. FED-STD-1007 is a mandatory standard and shall be used to establish coding and modulation requirements for duplex 9600 bits/second modems

owned or leased by the federal government for use over analog transmission channels terminated by four-wire" circuits.

3.2.1.2.11.1 Applicability. The standard shall be applicable to duplex 9600 bits/second modems (and equipment containing such modems) for use over nominal 4kHz analog channels terminated by four-wire" circuits.

3.2.1.2.11.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.2.11.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All duplex 9600 bits/second modems offered as a result of this solicitation for use with nominal 4kHz analog transmission channels shall comply with FED-STD-1007."

3.2.1.2.12 FED-STD-1008: Coding and Modulation Requirements for Duplex 600 and 1200 Bit/Second Modems. FED-STD-1008 is a mandatory standard and shall be used to establish coding and modulation requirements for duplex 600 bits/second and 1200 bits/second modems owned or leased by the federal government for use over analog transmission channels terminated by "two-wire" circuits.

3.2.1.2.12.1 Applicability. The standard shall be applicable to duplex 600 bit/second modems and/or 1200 bits/second modems (and equipment containing such modems) for use over nominal 4kHz analog channels terminated by "two-wire" circuits not acoustically coupled to telephone instruments.

3.2.1.2.12.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.2.12.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All two-wire duplex 600 bits/second and/or 1200 bits/second modems (except those to be acoustically coupled to telephone instruments) offered as a result of this solicitation for use with nominal 4kHz analog channels shall comply with FED-STD-1008."

3.2.1.2.13 FED-STD-1020: Electrical Characteristics of Balanced Voltage Digital Interface Circuits. FED-STD-1020 is a mandatory standard and shall be used to specify the electrical characteristics of balanced voltage digital interface circuits normally implemented in integrated circuit technology that are to be employed for the interchange of serial binary data, timing, and control signals between voice or data telecommunication equipment where information is being conveyed at the base band level at data signaling rates up to 10 megabits per second (Mb/s). This standard adopts the requirements of EIA-RS-422.

3.2.1.2.13.1 Applicability. The standard shall be applicable to equipment employing balanced voltage digital interface circuits.

3.2.1.2.13.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.2.13.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment using balanced voltage digital interface circuits that is offered as a result of this solicitation shall comply with the electrical characteristics addressed by FED-STD-1020."

3.2.1.2.14 FED-STD-1030: Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits. FED-STD-1030 is a mandatory standard and shall be used to specify the electrical characteristics of unbalanced voltage digital interface circuits normally implemented in integrated circuit technology that are to be employed for the interchange of serial binary data, timing, and control signals between voice or data telecommunication equipment where information is being conveyed at the baseband level at data signaling rates up to 100 kilobits per second (kb/s). This standard adopts the requirements of EIA-RS-423.

3.2.1.2.14.1 Applicability. The standard shall be applicable to equipment employing unbalanced voltage digital interface circuits.

3.2.1.2.14.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.2.14.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment using unbalanced voltage digital interface circuits that is offered as a result of this solicitation shall comply with the electrical characteristics addressed by FED-STD-1030."

3.2.1.2.15 FED-STD-1032: High Speed 25-position Interface for Data Terminal Equipment and Data Circuit-terminating Equipment. FED-STD-1032 is a mandatory standard and shall be used to specify the interconnection of data terminal equipment (DTE) and data circuit-terminating equipment (DCE) employing serial binary data interchange circuits with control information exchanged on separate control circuits. In particular, this standard defines the signal characteristics, interface mechanical characteristics, functional description of interchange circuits, and standard interfaces for selected communication system configurations. The electrical characteristics of the interchange circuits are specified by reference to EIA standards RS-422 (FED-STD-1020) and RS-423 (FED-STD-1030). FED-STD-1032 is a joint standard with FIPS PUB 154. This standard adopts the requirements of EIA-530.

3.2.1.2.15.1 Applicability. The standard shall be applicable to all telecommunication equipment employing high speed (20,000 to 2,000,000 bits/second) interchange between DTEs and DCEs.

3.2.1.2.15.2 Waivers. Waivers to this standard shall be obtained from the administrator.

3.2.1.2.15.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All telecommunication equipment using 20,000 to 2,000,000 bits/second interchange between DCEs and DTEs that is offered as a result of this solicitation shall comply with the electrical, mechanical, and functional characteristics addressed by FED-STD-1032."

3.2.1.2.16 Deleted.

3.2.1.2.17 Deleted.

3.2.1.2.18 Deleted.

3.2.1.3 Deleted.

3.2.1.4 Interchange codes, media and data files.

3.2.1.5 General Telecommunications standards.

3.2.1.5.1 FIPS PUB 58-1: Representation of Local Time of the Day for Information Interchange. FIPS PUB 58-1 is a mandatory standard and shall be used to provide the means for representing the local time of the day based upon both the 12- and 24- hour time-keeping systems for use in the interchange of information among data systems. It specifies the time elements and their representation of the meridian designator.

3.2.1.5.1.1 Applicability. The standard shall be applicable to all data systems which must use a coded time representation.

3.2.1.5.1.2 Waivers. Waivers to this standard shall be obtained from the Secretary of Commerce via the administrator.

3.2.1.5.1.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All data systems requiring the coding of the local time of day shall comply with FIPS PUB 58-1."

3.2.1.5.2 FIPS PUB 59: Representation of Universal Time Differentials and United States Time Zone References for Information. FIPS PUB 59 is a mandatory standard and shall be used to provide the means for representing universal time, local time differentials, and United States time zone references to facilitate interchange of data among data systems. It also provides the means whereby local time expressions can be related to universal time or a particular time zone.

3.2.1.5.2.1 Applicability. The standard shall be applicable to all data systems which must use a coded universal time representation.

3.2.1.5.2.2 Waivers. Waivers to this standard shall be obtained from the administrator.

3.2.1.5.2.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All data systems requiring the coding of universal time, local time differentials, and United States time zone references shall comply with FIPS PUB 59."

3.2.1.5.3 FIPS PUB 81: Data Encryption Standard (DES) Modes of Operations. FIPS PUB 81 is a mandatory standard that defines the modes of operation that shall be used with the Federal Data Encryption Standard described in FIPS PUB 46. These modes specify how sensitive computer data will be encrypted (cryptographically protected) and decrypted (returned to original form).

3.2.1.5.3.1 Applicability. The standard shall be applicable to equipment and services and requires compliance with FIPS PUB 46.

3.2.1.5.3.2 Waivers. Waivers to this standard shall be obtained from Secretary of Commerce via the administrator.

3.2.1.5.3.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Equipment and services offered as a result of this solicitation that implement the Data Encryption Standard (FIPS PUB 46) and that are intended for use in the cryptographic protection of sensitive but unclassified computer data shall use one or more of the modes of operation specified in FIPS PUB 81."

3.2.1.5.4 FED-STD-1002: Time and Frequency Reference Information in Telecommunications Systems. FED-STD-1002 is a mandatory standard and shall be used to establish the requirements for telecommunication facilities and systems of the federal government to utilize time and frequency reference information based upon Coordinated Universal Time (UTC).

3.2.1.5.4.1 Applicability. The standard shall be applicable to telecommunication facilities and systems dependent on time or frequency reference information.

3.2.1.5.4.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.5.4.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All applicable telecommunication facilities and systems that are offered or used as a result of this solicitation shall be referenced to the time and frequency standard specified in FED-STD-1002."

3.2.1.5.5 FED-STD-1026: Interoperability and Security Requirements for Use of the Data Encryption Standard in the Physical Layer of Data Communications. FED-STD-1026 is a mandatory standard and shall be used to facilitate the interoperation of government data communication facilities, systems, and data that require cryptographic protection using the Data Encryption Standard algorithm. The standard specifies interoperability and security related requirements using encryption at the Physical Layer

of the ISO Open Systems Interconnection (OSI) Basic Reference Model (ISO 7498) in the telecommunication systems conveying ADP and/or narrative text information.

3.2.1.5.5.1 Applicability. The standard shall be applicable to all Data Encryption Standard cryptographic components, equipment or services used for encryption of ADP and/or narrative text information in the Physical Layer data communications using the Data Encryption Standard algorithm.

3.2.1.5.5.2 Waivers. Waivers to this standard shall be obtained by the Administrator from the General Service Administration.

3.2.1.5.5.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All telecommunications equipment and systems used by the departments and agencies of the U.S. Government shall comply with the security requirements for the implementation of the Data Encryption Standard as addressed by FED-STD-1026."

3.2.1.5.6 FED-STD-1027: General Security Requirements for Equipment Using the Data Encryption Standard. FED-STD-1027 is a mandatory standard and shall be used to prescribe security requirements for implementation of the Data Encryption Standard in telecommunication equipment and systems used by the departments and agencies of the U.S. Government.

3.2.1.5.6.1 Applicability. The standard shall be applicable to DES cryptographic components, equipment, systems, and services procured by the U.S. Government for the encryption of digital information in the telecommunications environment. Agency heads or their designees shall refer to NCSC-11, the National Policy for Protection of Telecommunications Systems Handling Unclassified National Security - Related Information," in determining whether to require the use of this standard.

3.2.1.5.6.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.5.6.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "If a requirement for the encryption protection of unclassified digital information in the telecommunications environment is specified elsewhere in this requirements document, all cryptographic components, equipment, systems, and services offered to meet that requirement shall comply with FED-STD-1027 and be endorsed as so complying by the National Security Agency prior to being proposed. These items include stand alone DES cryptographic equipment as well as any data terminal equipment and data circuit-terminating equipment utilizing the DES algorithm (described in FIPS PUB 46) for digital encryption. Arrangements for endorsement shall be made with the communications Protection Special Project Office (S93), National Security Agency, 9800 Savage Road, Fort George G. Meade, MD 20755."

3.2.1.5.7 Deleted.

3.2.1.5.8 FED-STD-1033: Data Communications Systems and Service-user Oriented Performance Parameters. FED-STD-1033 is a mandatory standard and shall be used to improve federal government procurement of digital telecommunications systems and services by providing user-oriented and system dependent means of specifying communication performance.

3.2.1.5.8.1 Applicability. This standard shall be used by all federal departments and agencies in specifying the performance of data communication systems and services as perceived by end users.

3.2.1.5.8.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.5.8.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Performance specifications and equipment, systems, and services required to measure, evaluate, or monitor systems performance based on the parameters specified elsewhere in this requirements document (inset reference here) shall comply with FED-STD-1033."

3.2.1.5.9 FED-STD-1037: Glossary of Telecommunications Terms. FED-STD-1037 is a mandatory standard and shall be used by all federal departments and agencies for providing a comprehensive source of definitions and terms used in telecommunications and directly related fields by international, national, and U.S. Government telecommunications specialists.

3.2.1.5.9.1 Applicability. This standard shall be used by federal departments and agencies in defining terms used in specifications for telecommunications systems, equipment, and services.

3.2.1.5.9.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.2.1.5.9.3 Technical requirements portion of the solicitation. None.

3.2.1.5.10 FAA-STD-039: NAS Open Systems Architecture and Protocols. FAA-STD-039 shall be used in solicitation of computer network products, communications system products and equipment or services that provide equivalent functionality to the protocols defined in the standard.

3.2.1.5.10.1 Applicability. FAA-STD-039 shall be applicable to all computer network products, communications system products and equipment or services.

3.2.1.5.10.2 Waivers. Waivers to this standard shall be in accordance with provisions set forth in FAA Order 1830.2C, Telecommunications Standards Selection and Implementation Policy.

3.2.1.5.10.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All computer network and communications equipment, systems, and services offered as a result of this requirement shall comply with the general and specific protocol and service requirements contained in FAA-STD-039.

3.2.1.5.11 FAA-STD-049: Fiber Optic Telecommunication Systems and Equipment. FAA-STD-049 shall be used in solicitation of fiber optic telecommunication systems and equipment that provide equivalent functionality as defined in the standard.

3.2.1.5.11.1 Applicability. FAA-STD-049 shall be applicable to all fiber optic telecommunication systems and equipment providing functionalities in accordance with the standard.

3.2.1.5.11.2 Waivers. Waivers to this standard shall be in accordance with provisions set forth in FAA Order 1830.7, Fiber Optic Transmission Systems and Equipment policy.

3.2.1.5.11.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "The usage of fiber optic telecommunication systems and equipment shall be in accordance with requirements contained in FAA-STD-049. The selection of the types of fiber, cable construction, fiber optic network topologies and protocols shall be in accordance with FAA-STD-049."

3.2.1.5.12 FIPS PUB 182: Integrated Services Digital Network (ISDN). FIPS PUB 182 shall be used in conjunction with NIST Special Publication 500-195 (North American ISDN Users' Forum Agreements on Integrated Services Digital Network) in solicitation of computer services or products that provide the desired functionality specified in FIPS PUB 182.

3.2.1.5.12.1 Applicability. FIPS PUB 182 and NIST special publication 500-195 shall be applicable to all computer services and products providing functionalities in accordance with the ISDN FIPS.

3.2.1.5.12.2 Waivers. Waivers to this standard shall be approved by the Administrator, following the procedure contained in the waiver paragraph of FIPS PUB 182.

3.2.1.5.12.3 Technical requirements portion of the solicitation. FIPS PUB 182 shall be cited in solicitations and contracts initiated after April 15, 1994 as per the implementation paragraph of FIPS PUB 182. The minimum set of bearer services defined in ANSI.T1.603 for primary rate interface (PRI) shall be supported as mandated by FIPS PUB 182. The circuit mode digital bearer service, the circuit mode speech bearer service, and the circuit mode voiceband data bearer service shall be implemented in accordance with ANSI.T1.603 for PRI as specified in FIPS PUB 182.

For the network layer, the data link layer and the physical layer the following ISDN Trunk functional requirements shall apply. The network layer trunk operation shall comply with ANSI.T1.607 and ANSI.T1.615. The Data Link layer trunk operation shall comply with ANSI.T1.602. The Physical layer trunk interface shall comply with ANSI.T1.408.

For the data link layer and the physical layer the following Embedded Signaling Trunk Functional requirements shall apply. The data link layer trunk operation shall comply with ANSI T1.107. The physical layer trunk operation shall comply with ANSI T1.102.

3.2.1.5.13 Satellite Communications. The requirements for communication between the particular FAA facility and the satellite system shall be in accordance with specification documentation for the FAA Telecommunications Satellite (FAATSAT) system and any other documents or standards approved by the FAA for satellite communication usage.

3.2.1.5.13.1 Applicability. The FAATSAT specification documentation shall be applicable to satellite communication services being provided to the FAA facilities.

3.2.1.5.13.2 Waivers. Waivers shall be processed via the appropriate FAA change procedure.

3.2.1.5.13.3 Technical requirements portion of the solicitation. The FAATSAT specification shall be cited in solicitations and contracts for satellite communication services for FAA facilities.

3.2.1.6 International (treaty).

3.2.1.6.1 International telegraph alphabet number 2 (ITA-2). ITA-2 is defined in ICAO Annex 10, Volume I, Aeronautical Telecommunications. It shall be used to establish the 5-unit (bit) interchange code for low speed asynchronous applications for international aviation applications. The approved code and character font assignments, as well as unauthorized combinations for international use are specified.

3.2.1.6.1.1 Applicability. The standard shall be applicable to all teletypewriter equipment and systems used in the low speed portions of the Aeronautical Fixed Telecommunications Network (AFTN) where 5-unit (bit) code is used for data communications. This code set shall only be used if International Alphabet Number 5 (IA-5) cannot be implemented.

3.2.1.6.1.2 Waivers. Waivers to this standard shall be processed via the appropriate FAA change procedure. When used in international applications any waivers shall be negotiated and documented in a bilateral agreement, as well as filed with ICAO as an exception to Annex 10.

3.2.1.6.1.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "The system or equipment shall receive and transmit

characters in the format prescribed for 5-unit code (ITA-2) in paragraph 4.2.1 of ICAO Annex 10, Volume I for information interchange."

3.2.1.6.2 International Alphabet Number 5 (IA-5). IA-5 is defined in ICAO Annex 10, Volume I, paragraph 4.12.1.1. It shall be used to establish the 7-unit (bit) coded character set for information interchange for international applications. The approved code and font assignments, as well as notes, rules, and functional characteristics are provided.

3.2.1.6.2.1 Applicability. The standard shall be applicable to all equipment and systems used in the AFTN where 7-unit (bit) code is used for information interchange.

3.2.1.6.2.2 Waivers. Waivers to this standard shall be processed via the appropriate FAA change procedure. When used in international applications any waiver shall be negotiated and documented in a bilateral agreement, as well as filed with ICAO as an exception to Annex 10.

3.2.1.6.2.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "The equipment or system shall transmit and receive in the format prescribed for 7-unit code (IA-5) of ICAO in paragraph 4.12.1.1 of Annex 10, Volume I, for information interchange."

3.2.1.6.3 Code conversion. Code Conversion is defined in ICAO Annex 10, Volume I, paragraphs 4.12.1.2.4 and 4.12.1.2.5. It shall be used to provide the capability to do character for character and sequence conversions between the 5-unit (bit) and 7-unit (bit) code sets used for international applications. The use of this standard eliminates the incompatibilities that can arise when a network is comprised of equipment and users who need to exchange information and are using both code sets.

3.2.1.6.3.1 Applicability. The standard shall be applicable when conversion between ITA-2 and IA-5 for international information interchange is required.

3.2.1.6.3.2 Waivers. Waivers to this standard shall be processed via the appropriate FAA change procedures. When used in international applications any waivers shall be negotiated and documented in a bilateral agreement, as well as filed with ICAO as an exception to Annex 10.

3.2.1.6.3.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Code conversion between equipment and systems employing the 5-unit (bit) and 7-unit (bit) code sets of ICAO shall be in accordance with paragraphs 4.12.1.2.4 and 4.12.1.2.5 and the referenced code tables of Annex 10, Volume I."

3.2.1.6.4 System category A (CAT A) character oriented link control. System Category A is defined in ICAO Annex 10, Volume I. It shall be used to specify a two-way alternate, multipoint link protocol allowing either centralized or decentralized operation, and either single or multiple message-oriented information transfers without

replies, but with delivery verification. This standard is designed for computer to computer and computer to terminal multipoint applications.

3.2.1.6.4.1 Applicability. The standard shall be applicable for information transfer between computers or terminals in multipoint configurations, when IA-5 or ASCII (FIPS PUB 1-2) is used, and the use of a bit-oriented protocol such as high-level data link control procedures (HDLC) cannot be implemented.

3.2.1.6.4.2 Waivers. Waivers to this standard shall be processed via the appropriate FAA change procedure. When used in international applications any waivers shall be negotiated and documented in a bilateral agreement, as well as filed with ICAO as an exception to Annex 10.

3.2.1.6.4.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Data terminal, line controller, and related equipment that supports the link control procedure for System Category A shall do so in accordance with the relevant portions of paragraph 4.12.4.5 and Attachment H to Part 1 of Annex 10, Volume I."

3.2.1.6.5 System category B (CAT B) character oriented link control. System Category B is defined in ICAO Annex 10, Volume I. It shall be used to specify a two-way simultaneous, point to point protocol employing message associated blocking and modulo 8 numbering of blocks and acknowledgments.

3.2.1.6.5.1 Applicability. The document shall be applicable for information transfer between computers for point to point configurations, when IA-5 or ASCII (FIPS PUB 1-2) is used, and a bit-oriented (e.g. HDLC) protocol cannot be implemented.

3.2.l.6.5.2 Waivers. Waivers to this standard shall be processed via the appropriate FAA change procedure. When used in international applications any waivers must be negotiated and documented in a bilateral agreement, as well as filed with ICAO as an exception to Annex 10.

3.2.1.6.5.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Data terminal, line controller, and related equipment that supports the link control procedure for System Category B shall do so in accordance with the relevant portions of paragraph 4.12.4.6 and Attachment H to Part 1 of Annex 10, Volume I."

3.2.1.6.6 System category C (CAT C) character oriented link control. System Category C is defined in ICAO Annex 10, Volume I. It shall be used to specify a two-way alternate, multipoint protocol allowing only centralized (computer to/from terminal) operation, and single or multiple message transfers, with replies.

3.2.1.6.6.1 Applicability. The standard shall be applicable to information transfer between a computer and terminals for multipoint configuration, when IA-5 or ASCII (FIPS PUB 1-2) is used, and a bit-oriented (HDLC) protocol cannot be implemented.

3.2.1.6.6.2 Waivers. Waivers to this standard shall be processed via the appropriate FAA change procedure. When used in international applications any waivers must be negotiated and documented in a bilateral agreement, as well as filed with ICAO as an exception to Annex 10.

3.2.1.6.6.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Data terminal, line controller, and related equipment that supports the link control procedure for System Category C shall do so in accordance with the relevant portions of paragraph 4.12.4.7 and Attachment H to Part 1 of Annex 10, Volume I."

3.2.1.6.7 High-level data link control procedures. The HDLC procedures in ICAO document Annex 10, Volume I and II, are a mandatory standard and shall be used to specify a link control protocol that may be implemented in a multipoint normal response mode (NRM), a functional point to point asynchronous response mode (ARM) or a point to point asynchronous balanced mode (ABM) of operation. It provides for bit-oriented operation that allows any character structured code or bit stream data to be transferred. HDLC has fourteen optional function which may be used to modify the three modes of operation. HDLC modes and options are discussed in more detail in ISO standards ISO 3309 (HDLC Frame structure), ISO 4335 (Elements of Procedure), and ISO 7809 (Data Link Operation). Volume I of ICAO Annex 10 provides for bit-oriented operation that allows any character structured code or bit stream data to be transferred. Volume II provides the message descriptions and formats for the interoperability of the FAA Message Switched Networks.

3.2.1.6.7.1 Applicability. The document shall be applicable to synchronous information transfer (2400 bits per second and higher) between computers, or computers and terminals, in multipoint or point to point configurations, whereby the protocol is independent from the structure of the information being transferred. The ICAO implementation of this standard is the same as that specified by the International Organization for Standardization and allows interoperation with systems employing that standard. Volume II shall be applicable to all messages transmitted in the FAA Message Switched Network.

3.2.1.6.7.2 Waivers. Waivers to this standard shall be processed via the appropriate FAA change procedure. When used in international applications any waiver must be negotiated and documented as a bilateral agreement, as well as filed with ICAO as an exception to Annex 10, Volume I.

3.2.1.6.7.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Data terminal, line controller, and related computer equipment that supports HDLC procedures shall be in accordance with paragraph 4.12.3

and Attachment G to Part 1, of Annex 10, Volume I and the message formats and descriptions of Annex 10, Volume II."

3.3 Analog voice and data transmission characteristics and selection. This subsection describes, in summary form, the features or parameters of these selected standards.

3.3.1 Parameters and selection criteria.

3.3.1.1 Data communication over analog voice channels.

3.3.1.1.1 Publication (PUB) 41008: Transmission Parameters Affecting Voiceband Data Transmission - Description of Parameters. PUB 41008 is a voluntary document and shall be used to describe analog parameters which may affect data transmission over voiceband channels.

3.3.1.1.1.1 Applicability. This publication is used as a basis for engineering evaluations to establish data transmission technical requirements for customer provided data transmission equipment.

3.3.1.1.1.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All transmission technical requirements, for customer provided data transmission equipment shall comply with PUB 41008."

3.3.1.1.2 IEEE-STD 743-1984: Standard Methods and Equipment for Measuring the Transmission Characteristics of Analog Voice Frequency Circuits. IEEE-STD 783-1984 is a voluntary document and shall be used to outline general techniques in measuring transmission characteristics of telephone channels.

3.3.1.1.2.1 Applicability. This publication is used to define the engineering analysis procedure to determine viable customer provided data transmission test sets.

3.3.1.1.2.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Telephone channels shall have transmission characteristics measured in compliance with IEEE-STD 743-1984."

3.3.1.1.3 FED-STD-1015: Analog to Digital Conversion of Voice by 2,400 Bit/Second Linear Predictive Coding. FED-STD-1015 is a mandatory standard and shall be used to specify requirements relating to the conversion of analog voice to 2,400 bit/second digitized voice by Linear Predictive Coding (LPC-10) and reconversion back to analog voice.

3.3.1.1.3.1 Applicability. This standard applies to all synchronous (not packetized) 2,400 bit/second digitized voice telecommunications equipment procured or leased.

3.3.1.1.3.2 Waivers. Waivers to this standard shall be obtained from the General Services Administration via the administrator.

3.3.1.1.3.3 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All synchronous (not packetized) 2,400 Bit/Second Digitized Voice telecommunications equipment offered as a result of this requirement shall be capable of Linear Predictive Coding (LPC-10) operation in conformance with FED-STD-1015."

3.3.1.2 Transmission engineering.

3.3.1.2.1 TR-TSY-000007: Voice Frequency Network Channel Terminating Equipment Metallic Facilities. TR-TSY-000007 is a voluntary document and shall be used to state the minimal criteria necessary to determine whether voice frequency transmission and signaling equipment for metallic facilities is suitable for use on customer premises.

3.3.1.2.1.1 Applicability. This publication is applicable to any voice transmission or signaling equipment that is intended to interface with leased facilities.

3.3.1.2.1.2 Solicitation. The following wording is used in the solicitation: "All voice frequency transmission and signaling equipment for metallic facilities shall comply with TR-TSY-000007."

3.3.1.3 Private-line facilities.

3.3.1.3.1 PUB 43004: Functional Criteria-Voice Frequency Network Channel Terminating Equipment 4-wire Maintenance Terminating Unit. PUB 43004 is a voluntary document and shall be used to state requirements and objectives for a 4-wire maintenance terminating unit for voice frequency special services.

3.3.1.3.1.1 Applicability. This publication is applicable to automated maintenance procedures and built-in test equipment on customer provided hardware that interfaces leased voice frequency transmission facilities.

3.3.1.3.1.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All 4-wire maintenance terminating units for voice frequency special services shall comply with PUB 43004."

3.3.1.3.2 PUB 43101: Voice Grade Entrance Facilities for Extending Customer-provided Communications Channels. PUB 43101 is a voluntary document and shall be used to describe the various entrance facility serving arrangements, provide transmission characteristics of entrance facilities, describe signal power limitations, and discuss the division of responsibility for design, operation and maintenance.

3.3.1.3.2.1 Applicability. This publication is applicable to voice grade customer communications channels.

3.3.1.3.2.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Equipment interfacing to entrance facilities shall comply with PUB 43101."

3.3.1.3.3 PUB 43201: Private Line Interconnection Voice Applications. PUB 43201 is a voluntary document and shall be used to describe the standard private line offerings for voice applications which may be interconnected at one or both ends with customer-provided voice communications systems or terminal equipment. It also describes minimum protection criteria, signaling arrangements, and maintenance techniques.

3.3.1.3.3.1 Applicability. This publication is applicable to standard private line offerings for wire applications which may be interconnected with customer-provided voice communications systems and terminal equipment.

3.3.1.3.3.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Voice communications systems or terminal equipment connecting to private line offerings for wire applications shall comply with PUB 43201."

3.3.1.3.4 PUB 43701: Private Line Interconnection-Connection to a Channel of a Communications System. PUB 43701 is a voluntary document and shall be used to supply information concerning the technical parameters of leased private line services, and shall serve as both a design and ordering aid to the customer.

3.3.1.3.4.1 Applicability. This publication is applicable to interfaces between communications channels and private lines.

3.3.1.3.4.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing with leased private line services shall comply with PUB 43701."

3.3.1.3.5 PUB 43720: Private Line Interconnection-Operational Features of Bell System Switch Terminations. PUB 43720 is a voluntary document and shall be used to describe the technical content and use of the compatibility checklists which describe certain characteristics of a carrier switch termination including the type of outpulsing control that can be provided (delay dial, wink start, dial tone), the type of addressing that can be generated outgoing and accepted incoming (TOUCH-TONE or Dial Pulse), and the maximum number of digits that can be outpulsed.

3.3.1.3.5.1 Applicability. This publication is applicable to the specification of compatibility checklists.

3.3.1.3.5.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Equipment interfacing to a carrier switch terminations shall comply with PUB 43720."

3.3.1.3.6 FCC Rules and Regulations, Part 68: Connection of Terminal Equipment to the Telephone Network. FCC Rules and Regulations, part 68 is a voluntary document and shall be used to provide for uniform standards for the protection of the telephone network from harms caused by the connection of terminal equipment.

3.3.1.3.6.1 Applicability. This document shall be applicable to all terminal equipment, including PBX (or similar) systems, connected to the public switched telephone network.

3.3.1.3.6.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All terminal equipment connected to the public switched telephone network shall comply with FCC Rules and Regulations, Part 68."

3.3.1.4 Digital transmission systems: Asynchronous Digital Multiplexers - Requirements and Objectives.

3.3.1.4.1 TR-TSY-000009. TR-TSY-000009 is a voluntary document and shall be used to identify requirements and objectives that should be met to ensure satisfactory operation of digital multiplexes including the M1C, M12, M13, and M34 multiplexes; and the MC3, M13, and M23 options of the MX3 multiplex.

3.3.1.4.1.1 Applicability. This publication is applicable to digital multiplexers.

3.3.1.4.1.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "Digital multiplexers including the M1C, M12, M13, and M34 shall comply with TR-TSY-000009."

3.3.1.4.2 TR-TSY-000475: Operations Technology Generic Requirements: Network Maintenance: Transport Surveillance, Section. TR-TSY-000475 is a voluntary document and shall be used to describe facility maintenance features required for interoffice digital transmission systems, giving manufacturers of interoffice digital equipment the detailed requirements needed to incorporate maintenance features into the equipment that they manufacture.

3.3.1.4.2.1 Applicability. This publication is applicable to engineering assessments of communications network automated maintenance requirements for digital transmission systems.

3.3.1.4.2.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All interoffice digital transmission systems shall have maintenance features in compliance with TR-TSY-000475."

3.3.1.4.3 PUB 43804: Network Terminal Equipment Operations Interface Specification. PUB 43804 is a voluntary document and shall be used to provide suppliers of the network terminal equipment (NTE) and operations systems with the information necessary to follow the telephone companies standards on the NTE operations interfaces and with guidelines needed to interface NTEs with the RC operations system.

3.3.1.4.3.1 Applicability. This publication is applicable to network terminal equipment operations interfaces.

3.3.1.4.3.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation. "All network terminal equipment shall comply with PUB 43804."

3.3.1.5 Private-line channel network compatibility and performance specifications.

3.3.1.5.1 PUB 62103: High Performance Data Conditioning - Type D5 for Multi-point Private Line Data Channels. PUB 62103 is a voluntary document and shall be used to provide design rules and requirements for High Performance Data Conditioning (HPDC) Type D5 conditioning on Multi-Point Private Line (3002-Type) voice grade data channels.

3.3.1.5.1.1 Applicability. This publication is applicable to multi-point private line (3002-Type) voice grade data channels with HPDC-Type D5 conditioning.

3.3.1.5.1.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All circuits and equipment interfacing with multi-point private line (3002-Type) voice grade data channels with HPDC-Type D5 conditioning shall comply with PUB 62103."

3.3.1.5.2 PUB 62200: Group/Supergroup Spectra & Description and Interface Specification. PUB 62200 is a voluntary document and shall be used to provide customer interface and transmission specifications for Group (60-108 kHz) and Super group (312-552 kHz) service offerings.

3.3.1.5.2.1 Applicability. This publication is applicable to multiplex interfaces and equipment transmission requirements for customer provided equipment intended for interface to carrier private line networks.

3.3.1.5.2.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to Group (60-108 kHz) and Super group (312-552 kHz) service offerings shall comply with PUB 62200."

3.3.1.5.3 PUB 62310: Digital Data System Channel Interface Specification. PUB 62310 is a voluntary document and shall be used to describe the Digital Data System (DDS) interface with the customer's data terminal equipment, covering performance objectives; testing and maintenance considerations; DDS loop makeup and requirements; signal characteristics; and customer provided equipment requirements.

3.3.1.5.3.1 Applicability. This publication is applicable to interfaces between customer provided equipment and the DDS.

3.3.1.5.3.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All data terminal equipment interfacing to the Digital Data System (DDS) shall comply with PUB 62310."

3.3.1.5.4 PUB 62411: High Capacity Digital Service Channel Interface Specification. PUB 62411 is a voluntary document and shall be used to define the electrical and physical parameters at the Network Interface (NI) to comply with FCC Docket 81-216 which permits compatible operation of customer provided digital terminating equipment with High Capacity Digital Service (HCDS).

3.3.1.5.4.1 Applicability. This publication is applicable to HCDS network interfaces.

3.3.1.5.4.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment terminating at the network interface shall comply with PUB 62411."

3.3.1.5.5 TR-NPL-000334: Voice Grade Switched Access Service-transmission Parameter Limits and Interface Combinations. TR-NPL-000334 is a voluntary document and shall be used to describe Switched Access Services (SAS) provided to the Interlocal Access and Transport Area Carrier by the local carrier.

3.3.1.5.5.1 Applicability. This publication is applicable to interface with the switched access services system.

3.3.1.5.5.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to Switched Access Services (SAS) shall comply with TR-NPL-000334."

3.3.1.5.6 TR-NPL-000335: Voice Grade Special Access Service-transmission Parameter Limits and Interface Combinations. TR-NPL-000335 is a voluntary document and shall be used to describe the 13 voice grade and dedicated access lines special services in technical detail to allow each service to be incorporated into an end-to-end Interlocal Access and Transport Area Carrier offering.

3.3.1.5.6.1 Applicability. This publication is applicable to services provided on dedicated access lines by common carrier.

3.3.1.5.6.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to voice grade and dedicated access lines special services shall comply with TR-NPL-000335."

3.3.1.5.7 TR-NPL-000336: Metallic and Telegraph Grade Special Access Service Transmission Parameter Limits and Interface Combinations. TR-NPL-000336 is a voluntary document and shall be used to define the Narrowband Special Access Services distinguishing service features, technical specifications, and valid interfaces offered by the telephone companies to the Interlocal Access and Transport Area Carrier.

3.3.1.5.7.1 Applicability. This publication is applicable to the determination of the compatibility of services available to customer provided voice and data transmission systems.

3.3.1.5.7.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to Narrowband Special Access Services shall comply with PUB 62502."

3.3.1.5.8 TR-NPL-000337: Program Audio Special Access and Local Channel Interfaces. TR-NPL-000337 is a voluntary document and shall be used to describe the Program Audio Special Access Services distinguishing service features, technical specifications, and valid interfaces offered by the telephone companies to the Interlocal Access and Transport Area Carrier.

3.3.1.5.8.1 Applicability. This publication is applicable to determine the compatibility of services available to customer provided voice and data systems.

3.3.1.5.8.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to the Program Audio Special Access Services shall comply with TR-NPL-000337."

3.3.1.5.9 TR-NPL-000338: Television Special Access and Local Channel Services - Transmission Parameter Limits and Interface Combinations. TR-NPL-000338 is a voluntary document and shall be used to describe the Television Special Access Services' distinguishing service features, technical specifications, and valid interfaces offered by the telephone companies to the Interlocal Access and Transport Area Carrier.

3.3.1.5.9.1 Applicability. This publication is applicable to determining the compatibility of services available to customer video transmission systems.

3.3.1.5.9.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to the Television Access Service shall comply with TR-NPL-000338."

3.3.1.5.10 TR-NPL-000339: Wideband Analog Special Access Service Transmission Parameter Limits and Interface Combinations. TR-NPL-000339 is a voluntary document and shall be used to detail the Wideband Analog Special Access Services' distinguishing features, technical specifications, and valid interfaces offered by the telephone companies to the Interlocal Access and Transport Area Carrier.

3.3.1.5.10.1 Applicability. This publication is applicable to the determination of the compatibility of services available to customer voice and data transmission systems.

3.3.1.5.10.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to the Wideband Analog Special Access Service shall comply with TR-NPL-000339."

3.3.1.5.11 TR-NPL-000340: Wideband Data Special Access Service Transmission Parameter Limits and Interface Combinations. TR-NPL-000340 is a voluntary document and shall be used to describe the Wideband Digital Special Access Services' distinguishing service features, technical specifications, and valid interfaces offered by carriers to the Interlocal Access and Transport Area Carrier.

3.3.1.5.11.1 Applicability. This publication is applicable to the determination of the compatibility of services available to customer provided voice and data transmission systems.

3.3.1.5.11.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to the Wideband Digital Special Access Service shall comply with TR-NPL-000340."

3.3.1.5.12 TR-NPL-000341: Digital Data Special Access Service-transmission Parameters and Interface Combinations. TR-NPL-000341 is a voluntary document and shall be used to describe the Digital Data Special Access Services' distinguishing service features, technical specifications and valid interfaces offered by the telephone companies to the Interlocal Access and Transport Area Carrier.

3.3.1.5.12.1 Applicability. This publication is applicable to high speed multiplex channels and customer provided equipment interface channels.

3.3.1.5.12.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to the Digital Data Special Access Service shall comply with PUB 62507."

3.3.1.5.13 PUB 62113: Network Channel Interface Specifications for Off-premises Station Lines (PBX End) Facility Interface Codes OL13A, OL13B, and OL13C. PUB 62113 is a voluntary document and shall be used to interface to private line off-premises station lines that accommodate Registered Terminal Equipment having facility interface codes OL13A, OL13B and OL13C.

3.3.1.5.13.1 Applicability. This publication is applicable to customer-provided remote telephone stations that will interface customer owned PBXs or leased lines.

3.3.1.5.13.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All registered terminal equipment having facility interface codes OL13A, OL13B, and OL13C which interface to private line off-premises station lines shall comply with PUB 62113."

3.3.1.5.14 PUB 62114: Network Channel Interface Specifications for Tie Trunk-like Channel's Accommodating Four Wire Lossless Registered Terminal Equipment That Originates on M-Lead Facility Interface Codes TL31M and TL32M. PUB 62114 is a voluntary document and shall be used to describe the interface to private line

tie trunks that accommodate Four Wire Lossless, Type I and Type II E and M Connections (M-Lead originates).

3.3.1.5.14.1 Applicability. This publication is applicable to interface customer-provided equipment to PBX tie trunks.

3.3.1.5.14.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to private line tie trunks that accommodate four-wire lossless, Type 1 and Type II E and M connections (M-Lead originates) shall comply with PUB 62114."

3.3.1.5.15 PUB 62115: Network Channel Interface Specifications for Tie Trunk-like Channel's Accommodating Four Wire Lossless Registered Terminal Equipment That Originates on E-Lead Facility Interface Code TL31E and TL32E. PUB 62115 is a voluntary document and shall be used to describe the interface to private line tie trunks that accommodate Four Wire Lossless, Type I and Type II E and M Connections (E-Lead originates).

3.3.1.5.15.1 Applicability. This publication is applicable to interfacing customer provided equipment to PBX tie trunks.

3.3.1.5.15.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to private line tie trunks that accommodate four-wire lossless, Type I and Type II E and M Connections (E-Lead originates) shall comply with PUB 62115."

3.3.1.5.16 TA-NPL-000342: High-capacity Digital Special Access Service Transmission Parameter Limits and Interface Combinations. TA-NPL-000342 is a voluntary document and shall be used to define High Capacity Digital Access Services' distinguishing service features, technical specifications and valid interfaces offered by the telephone companies to the Interlocal Access and Transport Area Carrier.

3.3.1.5.16.1 Applicability. This publication is applicable to equipment interfacing the High Capacity Digital Access Service.

3.3.1.5.16.2 Technical requirements portion of the solicitation. The following wording shall be used in the solicitation: "All equipment interfacing to the High Capacity Digital Access Service shall comply with TA-NPL-000342."

4. QUALITY ASSURANCE PROVISIONS

This section is not applicable to this standard.

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5. PREPARATION FOR DELIVERY

This section is not applicable to this standard.

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6. NOTES

6.1 Acronyms and abbreviations. The following are definitions of acronyms and abbreviations used in this standard.

ABM	Asynchronous Balanced Mode
ADP	Automatic Data Processing
AFTN	Aeronautical Fixed Telecommunications Network
ANSI	American National Standards Institute
ARM	Asynchronous Response Mode
ASCII	American Standard Code for Information Interchange
AT&T	American Telephone and Telegraph
bpi	Bits per inch
bpmm	Bits per millimeter
Byte	Block of eight bits of data
b/s	Bits per second
CAT A	System Category A
CAT B	System Category B
CAT C	System Category C
CCITT	International Telephone and Telegraph Consultive Committee
CPE	Customer provided equipment
CPI	Characters per inch
cpmm	Characters per millimeter
CRT	Cathode Ray Tube
CSMA/CD	Carrier Sense Multiple Access/Collision Detection
DCE	Data Circuit-Terminating Equipment

DDS	Digital Data System
DES	Data Encryption Standard
DTE	Data Terminal Equipment
EIA	Electronic Industry Association
FAA	Federal Aviation Administration
FAATSAT	Federal Aviation Administration Telecommunications Satellite System
FCC	Federal Communications Commission
FED	Federal Standard
FIPS	Federal Information Processing Standard
FIPS PUB	Federal Information Processing Standard Publication
GSA	General Services Administration
HCDS	High Capacity Digital Service
HDLC	High Level Data Link Control Procedures
HPDC	High-Performance Data Conditioning
IA-5	International Alphabet Number 5
ICAO	International Civil Aviation Organization
IEEE	Institute of Electrical Electronic Engineers
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ITA-2	International Telegraph Alphabet Number 2
ITU-T	International Telecommunication Union - Telecommunications Standardization Sector
k	Kilo
kb/s	Kilobits per second
kHz	Kilohertz
LAN	Local Area Network
LPC	Linear Predictive Coding
Mb/s	Megabits per second

mm	millimeter
NAS	National Airspace System
NCSC	National Communications Security Committee
NI	Network Interface
NIST	National Institute of Standards and Technology (NIST)
NRM	Normal Response Mode
NRZI	Non-Return to Zero Inverted
NTE	Network Terminal Equipment
OSI	Open Systems Interconnection
OTGR	Operations Technology Generic Requirements
PBX	Private Branch Exchange
PRI	Primary Rate Interface
PSTN	Public Switched Telephone Network
PUB	Publication
RC	Regional Company
SAS	Switched Access Services
SF-277	Standard Form 277
STD	Standard
TR	Technical Reference
US	United States
UTC	Coordinated Universal Time

6.2 AT&T BELLCORE publications. Since divestiture, Bell Communications Research (BELLCORE) has taken responsibility for issuing Technical References (TR) on behalf of the Bell Operating Companies (BOC) and AT&T. Many Technical References (PUBs) and other documents from AT&T and the former Bell System have not been updated to BELLCORE TRs. In general, these older documents will be technically accurate; however, care should be taken to ensure that any terminology or referenced information is not obsolete. Specification writers should, as a matter of practice, review BELLCORE TR to determine if one or more BELLCORE TR might be applicable. Specifications, however, should not be tailored BOC products.

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APPENDIX I

10. VOICE STANDARDS: SELECTION CRITERIA AND APPLICATION

10.1 SCOPE

10.1.1 Scope. This appendix contains, in summary form, a description of the features and parameters of the Voice Standards. Selection criteria is included where appropriate.

10.1.2 Purpose. This Appendix presents analog and digital transmission standards and is arranged by area of applicability including telephone equipment compatibility, data communication, transmission, engineering, private line facilities, digital transmission systems, testing, and private line channel network compatibility. Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.

10.2 SELECTION CRITERIA

10.2.1 Parameters and selection. This subsection contains the basic information necessary to describe in summary form the features and parameters of the standard relating to voice circuits, as well as their applicability.

10.2.1.1 Telecommunications standards - telephone equipment compatibility. These documents define the characteristics necessary to assure compatibility between AT&T or

Other Common Carrier (OCC) equipment and Customer-provided Equipment (CPE). Because of the breakup of the Bell Telephone System, these documents have become de facto industry standards for telephone systems, since most existing equipment remains the property of AT&T and is connected to other common carriers only in accordance to the specifications in these documents. These documents are pertinent if an equipment item/subsystem interfaces with the Public Switched Telephone Network (PSTN) or other leased lines. A description of each is listed with comments on applicability to FAA-specific networks and equipment.

10.2.1.1.1 2,400 b/s digitized voice. FED-STD-1015 is applicable for all implementations of digitized voice at 2,400 b/s using LPC-10.

10.2.1.1.2 Signaling characteristics among PBXs. RS-464 is applicable to PBX switching equipment in voiceband applications.

10.2.1.1.3 Loop signaling. RS-470 should be used to define loop signaling for voiceband applications.

10.2.1.1.4 RS-496. This standard is used for connection to national and public switched networks (analog) between the DCE and the network.

10.2.1.2 Data communications. These documents indicate the characteristics and interface requirements for the use of voice grade circuits for data transmission.

10.2.1.2.1. Interface circuit characteristics. FED-STD-1020 (RS-422) specifies the electrical characteristics of balanced voltage digital interface circuits that are to be employed for the interchange of serial binary data, timing, and control signals between voice or data telecommunication equipment where information is being conveyed at the DC baseband level at data signaling rates up to 10 Megabits per second. FED-STD-1030 (RS-423) specifies the electrical characteristics of unbalanced voltage digital interface circuits that are to be employed for the interchange of serial binary data, timing, and control signals between voice or data telecommunication equipment where information is being conveyed at the DC baseband level at data signaling rates up to 100 kilobits per second. Both standards apply to equipment employing balanced or unbalanced interface circuits.

10.2.1.2.2 Analog parameters for data transmission. PUB-41008 is a tutorial describing analog parameters which may affect data transmission over voiceband channels. This publication is used as a basis for engineering evaluations to establish data transmission technical requirements for customer-provided data transmission equipment.

10.2.1.2.3 Measurement of data transmission characteristics. IEEE Standard 783-1984 outlines general techniques used in measuring transmission characteristics of telephone channels. This engineering analysis procedure is be used to determine viable customer-provided data transmission test sets.

10.2.1.3 Transmission engineering. Technical references in the following paragraphs provide the criteria for terminating and testing customer-provided equipment which interfaces to the transmission media (e.g., leased lines).

10.2.1.3.1 Criteria for voice frequency transmission and signaling equipment. TR-TSY-000007 gives the minimal criteria necessary to determine whether voice frequency transmission and signaling equipment for metallic facilities is suitable for use on customer premises. It is a compilation of requirements and objectives together with compliance test procedures for determining if specific products meet the stated criteria. This is applicable to any piece of voice transmission or signaling equipment that is intended to interface with leased facilities.

10.2.1.3.2 Maintenance terminating units. PUB 43003 provides requirements and objectives for a 2-wire maintenance terminating unit for voice frequency special services. A maintenance terminating unit is a device that is placed on the network side of the demarcation point at a customer location as an aid in determining proper performance of the channel without dispatching a craftsperson to the customer location. PUB-43004 provides requirements and objectives for a 4-wire maintenance terminating unit for voice frequency special services. These publications are applicable to automated maintenance procedures and built-in test equipment on customer-provided hardware that interfaces leased voice frequency transmission facilities.

10.2.1.4 Private line facilities. Technical references in the following three paragraphs describe interfaces to private line facilities by customer- provided systems and equipment.

10.2.1.4.1 Equipment interface to voice grade communications channels. PUB-43101 describes the various entrance facility serving arrangements, provides transmission characteristics of entrance facilities, describes signal power limitations and discusses the division of responsibility for design, operation and maintenance. This is applicable to any customer-provided equipment intended to interface with voice grade communications channels. PUB 43201 describes the standard private line offerings for voice applications which may be interconnected at one or both ends with customer-provided voice communications systems or terminal equipment. They describe minimum protection criteria, signaling arrangements and maintenance techniques. These are applicable to any customer-provided communications equipment intended to interface leased private lines.

10.2.1.4.2 Private line devices. PUB 43701 supplies information concerning the technical parameters of private line services. The document describes the voiceband services which can be provided, associates each service with all applicable terminations, and describes the functional operation of the service. In addition, PUB 43701 lists the interfaces with which the services can be terminated whenfor connectingion to a customer or OCC provided communications channel. It also describes, in detail, the characteristics of each interface.

PUB 43701 should be used when an interface to the communications channels exists. A summary of the operational features of telephone company-provided switching equipment located at the remote ends of the customer's composite communications configuration will be supplied (to the customer) to allow the customer to ensure the compatibility of the remote terminations.

PUB 43720 describes the technical content and use of the compatibility checklists. These forms are provided by the operating telephone company to the customer and describe certain characteristics of the Bell switch termination. These characteristics include the type of outpulsing control that can be provided (delay dial, wink start, dial tone), the type of addressing that can be generated outgoing and accepted incoming (TOUCH-TONE or Dial Pulse), and the maximum number of digits that can be outpulsed. PUB 43720 is used in conjunction with PUB 43701.

10.2.1.5 Digital transmission systems. Technical references in the following three paragraphs describe the requirements for an interface to digital systems as provided by Bell or other-common carriers.

10.2.1.5.1 Facility maintenance features. TR-TSY-000475 describes facility maintenance features required for interoffice digital transmission systems. This document gives manufacturers of interoffice digital equipment the detailed requirements needed to incorporate maintenance features into the equipment that they manufacture. These requirements are consistent with the Bell Plan for centralized and automated maintenance of the highly complex rapidly growing digital network. This publication is used as an engineering assessment of communications network automated maintenance requirements for digital transmission systems.

10.2.1.5.2 Network terminal equipment. PUB 43804 provide suppliers of the Network Terminal Equipment (NTE) and operations systems with the information necessary to follow the regional companies standards on the NTE operations interfaces and with guidelines needed to interface NTEs with the regional companies operations system. Operations planners are provided with technical details and future directions for the integration of the NTE operations support with its operations systems and operations centers. The implementation of centralization and mechanization of NTE operations support as expounded in the Integrated Special Services Network (ISSN) is also covered for planners. This is applicable to areas such as network control and tandem switch configuration control.

10.2.1.5.3 Digital channel banks. PUB 43801 provides requirements and objectives for digital terminals that convert 24, 48, or 96 voice channels into 1.544 (DS-1), 3.152 (DS-1C) or 6.312 (DS-2) Mbps digital signals along with associated signaling and alarm information for transmission over digital facilities. This document covers both digital and analog transmission requirements and includes test procedures for determining compliance with the requirements.

10.2.1.6 Private line channel network compatibility and performance specifications. These technical references describe the network to customer-provided equipment interface and are applicable as indicated.

10.2.1.6.1 HPDC - type D5 conditioning on voice grade data channels. PUB 62103 provides design rules and requirements for HPDC-Type D5 Conditioning on Multipoint Private Line (3002-Type) voice grade data channels. This is applicable to high speed multiplex channels and customer-provided equipment interface channels.

10.2.1.6.2 Interface to private line off-premises station lines. PUB 62113 describes the interface to private line off-premises station lines that accommodate registered terminal equipment having facility interface codes OL13A, OL13B and OL13C. This applies to customer-provided remote telephone stations that will interface customer owned PBXs over leased lines.

10.2.1.6.3 Network channel interface for tie trunks that accommodate registered terminal equipment. PUB 62114 describes the interface to private line tie trunks that accommodate four wire lossless, Type I and Type II E and M Connections (M-Lead originates). PUB 62115 describes the interface to private line tie trunks that accommodate four wire lossless, Type I and Type II E and M Connections (E-Lead originates). This is the standard for the interfacing of customer-provided equipment to PBX tie trunks.

10.2.1.6.4 Group and supergroup service offerings. PUB 62200 provides customer interface and transmission specifications for group (60-108 kHz) and supergroup (312-552 kHz) service offerings. This is applicable to multiplex interfaces and equipment transmission requirements for customer-provided equipment intended for interface to Bell System private line channel network.

10.2.1.6.5 Digital data system interface. PUB 62310 describes the Digital Data System (DDS) interface to the customer's data terminal equipment. Performance objectives, testing and maintenance considerations, DDS loop makeup and requirements, signal characteristics and customer-provided equipment requirements are covered. It is used to describe signal characteristics and interface requirements for customer provided equipment intended for use on DDS.

10.2.1.6.6 Network interface. PUB 62411 defines the electrical and physical parameters at the Network Interface (NI) to comply with FCC Docket 81-216 which permits compatible operation of customer provided digital terminating equipment with High Capacity Digital Service (HCDS). The reference is applicable to customer-provided high speed data equipment intended with the high capacity digital services.

10.2.1.6.7 Switched access services. TR-NPL-000334 describes Switched Access Services (SAS) provided to the interexchange carrier by the telephone company. SAS offerings are described by providing transmission and interface technical details for each

feature group. It is used to detail available features provided by the telephone company on the switched access services system.

10.2.1.6.8 Dedicated access line special services. TR-NPL-000335 describes the 13 voice grade and dedicated access lines special services in technical detail to allow each service to be incorporated into an end-to-end interexchange carrier offering. Service offerings have been condensed into fewer offerings defined by technical differences rather than use of differences. It is used to describe available services provided on dedicated access lines by common carrier.

10.2.1.6.9 Metallic and telegraph grade special access services. TR-NPL-000336 covers the Metallic and telegraph grade Special Access Services distinguishing service features, technical specifications and valid interfaces offered by the telephone companies to the interexchange carrier. It is pertinent to the determination of the compatibility of services available to customer voice and data transmission systems.

10.2.1.6.10 Program audio special access services. TR-NPL-000337 describes the Program Audio Special Access Services' distinguishing service features, technical specifications and valid interfaces offered by the telephone companies to the interexchange carrier. It is used to determine the compatibility of services available to customer voice and data transmission systems.

10.2.1.6.11 Television special access services. TR-NPL-000338 describes the Television Special Access Services' distinguishing service features, technical specifications and valid interfaces offered by the telephone companies to the interexchange carrier. It is used to determine the compatibility of services available to customer voice and data transmission systems.

10.2.1.6.12 Wideband special access services. TR-NPL-000339 details the Wideband Analog Special Access Services' distinguishing service features, technical specifications and valid interfaces offered by the telephone companies to the interexchange carrier. TR-NPL-000339 describes the Wideband Digital Special Access Services' distinguishing service features, technical specifications and valid interfaces offered by the telephone companies to the interexchange carrier. They are used to determine the compatibility of services available to customer voice and data transmission systems.

10.2.1.6.13 Digital access services. TR-NPL-000341 covers the Digital Data Special Access Services' Distinguishing service features, technical specifications and valid interfaces offered by the telephone companies to the interexchange carrier. TR-NPL-000342 covers High Capacity Digital Access Services' distinguishing service features, technical specifications and valid interfaces offered by the telephone companies to the interexchange carrier. These documents are used to determine the compatibility of services available to customer voice and data transmission systems.

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APPENDIX II

20. INDEX OF STANDARDS

20.1 Standards

Annex 10,	Aeronautical Telecommunications	3.2.1.6.1
Volume I		3.2.1.6.1.3
(ICAO)		3.2.1.6.2
		3.2.1.6.2.3
		3.2.1.6.3
		3.2.1.6.3.3
		3.2.1.6.4
		3.2.1.6.4.3
		3.2.1.6.5
		3.2.1.6.5.3
		3.2.1.6.6
		3.2.1.6.6.3
		3.2.1.6.7

		3.2.1.6.7.2
		3.2.1.6.7.3
Annex 10,	Aeronautical Telecommunications	3.2.1.6.7
Volume II		3.2.1.6.7.3
(ICAO)		
FAA-E-FAATSAT	FAA Telecommunicationss	3.2.1.5.13
	Satellite System	3.2.1.5.13.1
		3.2.1.5.13.2
		3.2.1.5.13.3
FAA-STD-039	National Airspace System (NASS)	3.2.1.5.10
	Open Systems Architecture and	3.2.1.5.10.1
	Protocols	3.2.1.5.10.2
		3.2.1.5.10.3
FAA-STD-049	Fiberr Optic telecommunication	3.2.1.5.11
	Systems and Equipment	3.2.1.5.11.1
		3.2.1.5.11.2
		3.2.1.5.11.3
FED-STD-1002	Time and Frequency Reference	3.2.1.5.4
	Information Telecommunication	3.2.1.5.4.3
	Systems	
FED-STD-1005	Coding and Modulation Requirements	3.2.1.2.9
	for 2400 Bit/Second Modems	3.2.1.2.9.3
FED-STD-1006	Coding and Modulation Requirements	3.2.1.2.10
	for 4800 Bit/Second Modems	3.2.1.2.10.3
FED-STD-1007	Coding and Modulation Requirements	3.2.1.2.11
	for Duplex 9600 Bit/Second Modems	3.2.1.2.11.3
FED-STD-1008	Coding and Modulation Requirements	3.2.1.2.12
	for Duplex 600 and 1200 Bit/Second	3.2.1.2.12.3

	Modems	
FED-STD-1010	Bit Sequencing of the American	3.2.1.2.1
/FIPS PUB 16-1	National Standard Code for	3.2.1.2.1.3
	Information Interchange in	
	Serial-by-Bit Data Transmission	
FED-STD-1011	Character Structure and Character	3.2.1.2.2
/FIPS PUB 17-1	Parity for Serial-by-Bit Data	3.2.1.2.2.3
	Communication in the code for	
	Information Interchange	
FED-STD-1012	Character Structure and Character	3.2.1.2.3
/FIPS PUB 18-1	Parity Sense for Parallel-by-Bit	3.2.1.2.3.3
	Data Communication in the American	
	National Standard Code for	
	Information Interchange	
FED-STD-1013	Synchronous Signaling Rates	3.2.1.2.4
/FIPS PUB 22-1	Between Data Terminal Equipment	3.2.1.2.4.3
	and Data Circuit-Terminating	
	Equipment Utilizing 4kHz Circuits	
FED-STD-1015	Analog to Digital Conversion of	3.3.1.1.3
	Voice by 2,400 Bit/ Second Linear	3.3.1.1.3.3
	Predictive Coding.	10.2.1.1.1
FED-STD-1020	Electrical Characteristics of	3.2.1.2.13
	Balanced Voltage Digital	3.2.1.2.13.3
	Interface Circuits	3.2.1.2.15
		10.2.1.2.1
FED-STD-1026	Interoperability and Security	3.2.1.5.5
	Requirements for Use of the Data	3.2.1.5.5.3
	Encryption Standard in the	
	Physical Layer of Data	

	Communications	
FED-STD-1027	General Security Requirements	3.2.1.5.6
	for Equipment Using the Data	3.2.1.5.6.3
	Encryption Standard	
FED-STD-1030	Electrical Characteristics of	3.2.1.2.14
	Unbalanced Voltage Digital	3.2.1.2.14.3
	Interface Circuits	3.2.1.2.15
		10.2.1.2.1
FED-STD-1032	High Speed 25-Position Interface	3.2.1.2.15
/FIPS PUB 154	for Data Terminal Equipment	3.2.1.2.15.3
	and Data Circuit-terminating	
	Equipment.	
FED-STD-1033	Data Communications Systems and	3.2.1.5.8
	Service-User Oriented Performance	3.2.1.5.8.3
	Parameters.	
FED-STD-1037	Glossary of Telecommunications	3.2.1.5.9
	Terms	
FIPS PUB 1-2	Code for Information Interchange,	3.2.1.1.1
	its Representation, Subsets, and	3.2.1.1.1.3
	Extensions	3.2.1.1.2
		3.2.1.1.7.3
		3.2.1.1.6.3
		3.2.1.1.7
		3.2.1.1.7.1
		3.2.1.1.7.3
		3.2.1.2.1.3
		3.2.1.2.2
		3.2.1.2.2.1

		3.2.1.2.2.3
		3.2.1.2.3
		3.2.1.2.3.1
		3.2.1.2.3.3
		3.2.1.6.4.1
		3.2.1.6.5.1
		3.2.1.6.6.1
FIPS PUB 16-1	Bit Sequencing of the Code for	3.2.1.2.1
/FED-STD-1010	Information Interchange in	3.2.1.2.1.3
	Serial Bit-By-Bit Data	3.2.1.2.1.3
	Transmission	3.2.1.2.1.3
FIPS PUB 17-1	Character Structure and Character	3.2.1.2.2
/FED-STD-1011	Parity Sense for Serial-by-Bit Data	3.2.1.2.2.3
	Communication in the Code for	
	Information Interchange	
FIPS PUB 18-1	Character Structure and Character	3.2.1.2.3
/FED-STD-1012	Parity Sense for Parallel-by-Bit	3.2.1.2.3.3
	Data Communication in the Code	
	for Information Interchange.	
FIPS PUB 22-1	Synchronous Signaling Rates	3.2.1.2.4
/FED-STD-1013	Between Data Terminal and Data	3.2.1.2.4.3
	Communication Equipment.	
FIPS PUB 46	Data Encryption Standard	3.2.1.5.3
		3.2.1.5.3.1
		3.2.1.5.3.3
		3.2.1.5.6.3
FIPS PUB 58-1	Representation of Local Time of	3.2.1.5.1
	the Day for Information	3.2.1.5.1.3

	Interchange	
FIPS PUB 59	Representation of Universal Time,	3.2.1.5.2
	Local Time Differentials and	3.2.1.5.2.3
	United States Time Zone References	
	for Information Interchange	
FIPS PUB 81	Data Encryption Standard (DES)	3.2.1.5.3
	Modes of Operations	3.2.1.5.3.3
FIPS PUB 86	Additional Controls for uUse with	3.2.1.1.7
	American National Standard Code	3.2.1.1.7.3
	for Information Interchange	
FIPS PUB 107	Local Area Networks: Baseband	3.2.1.2.7
	Carrier Sense Multiple Access	3.2.1.2.7.3
	With Collision Detection Access	
	Method and Physical Layer	
	Specifications and Link Layer	
	Protocol.	
FIPS PUB 154	High Speed 25-Position Interface	3.2.1.2.15
/FED-STD-1032	for Data Terminal Equipment and	3.2.1.2.15.3
	Data Circuit-terminating	
	Equipment	
FIPS PUB 182	Integrated Services Digital	3.2.1.5.12
	Network (ISDN)	3.2.1.5.12.1
		3.2.1.5.12.2
		3.2.1.5.12.3
NCSC-11	National Policy for Protection of	3.2.1.5.6.1
	Telecommunications Systems	
	Handling Unclassified National	
	Security Information	

NIST Special Publication 500-195	North American ISDN Users' Forum Agreements on Integrated Services	3.2.1.5.12 3.2.1.5.12.1
ISO 2110:1989	Information Technology - Data Communication - 25-Pin Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) Interface Connector and Contact Number Assignments, 3rd Edition	3.2.1.2.5
ISO 3309:1991	Information Processing Systems -Data Communication - High-level Data Link Control Procedures - Frame Structure, 4th Edition	3.2.1.6.7
ISO 4335:1987	Information Processing Systems- Data Communication - High-level Data Link Control (HDLC) Elements of Procedures, 3rd Edition	3.2.1.6.7
ISO 7498:1984	Information Processing Systems - Open Systems Interconnection - Part 1: Basic Reference Model, 1st Edition	3.2.1.5.5
ISO 7809:1984	Information Processing Systems - Data Communication - High-level Data Link Control Procedures - Consolidation of Classes of Procedures, 1st Edition	3.2.1.6.7
IEEE-STD 743	IEEE Standard Methods and	3.3.1.1.2

	Equipment for Measuring the Transmission Characteristics of Analog Voice Frequency Circuits	3.3.1.1.2.2
IEEE 802.3	Local Area Networks Carrier Sense Multiple with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications	3.2.1.2.7.3
FCC Rules and Regulations, Part 68	Connection of Terminal Equipment to the Telephone Network	3.3.1.3.6 3.3.1.3.6.2
ANSI.T1.102	Digital Hierarchy - Format Specifications	3.2.1.5.12.3
ANSI.T1.107	Digital Hierarchy - Electrical interfaces	3.2.1.5.12.3
ANSI.T1.408	Telecommunications - Integrated Services Digital Network (ISDN) - Primary Rate - Customer Installation Metallic Interfaces - Layer 1 Specification	3.2.1.5.12.3
ANSI.T1.602	Telecommunications - Integrated Services Digital Network (ISDN) - Data Link Layer Signaling Specification for Application at the User-Network Interface	3.2.1.5.12.3
ANSI.T1.603	Telecommunications - Integrated Services Digital Network (ISDN)	3.2.1.5.12.3

	- Minimal Set of Bearer Services for the Primary Rate Interface.	
ANSI.T1.607	Telecommunications - Integrated Services Digital Network (ISDN) - Digital Subscriber Signaling System Number 1 (DSS1) - Signaling Specification for Circuit Switched Bearer Service.	3.2.1.5.12.3
ANSI.T1.615	Telecommunications - Digital Subscriber Signaling System No. 1 (DSS) 1 - Layer 3 Overview	3.2.1.5.12.3
PUB 41008	Transmission Parameters Affecting Voiceband Data Transmission - Description of Parameters	3.3.1.1.1 3.3.1.1.1.2
PUB 43004	Functional Criteria - Voice Frequency Network Channel Terminating Equipment-4 Wire Maintenance Terminating Unit	3.3.1.3.1 3.3.1.3.1.2
PUB 43101	Voice Grade Entrance Facilities for Extending Customer-Provided Communications Channels	3.3.1.3.2 3.3.1.3.2.2
PUB 43201	Private Line Interconnection Voice Applications	3.3.1.3.3 3.3.1.3.3.2 10.2.1.4.1
PUB 43701	Private Line Interconnection-Connection to a Channel of a Communications System	3.3.1.3.4 3.3.1.3.4.2 10.2.1.4.2
PUB 43720	Private Line Interconnection-	3.3.1.3.5

	Operational Features of Bell	3.3.1.3.5.2
	System Switch Terminations	10.2.1.4.2
PUB 43801	Digital Channel Bank -	10.2.1.5.3
	Requirements and Objectives	
PUB 43804	Network Terminal Equipment	3.3.1.4.3
	Operations Interface	3.3.1.4.3.2
	Specification	10.2.1.5.2
PUB 62103	High Performance Data	3.3.1.5.1
	Conditioning - Type D5 for	3.3.1.5.1.2
	Multipoint Private Line Data	10.2.1.6.1
	Channels	
PUB 62113	Network Channel Interface	3.3.1.5.13
	Specifications for Off-Premises	3.3.1.5.13.2
	Station Lines (PBX End) Facility	10.2.1.6.2
	Interface Codes OL13A, OL13B,	
	OL13C	
PUB 62114	Network Channel Interface	3.3.1.5.14
	Specifications for Tie Trunk-like	3.3.1.5.14.2
	Channel's Accommodating Four Wire	10.2.1.6.3
	Loss-less Registered Terminal	
	Equipment That Originates on	
	M-Lead Facility Interface Codes	
	TL31M and TL32M	
PUB 62115	Network Channel Interface	3.3.1.5.15
	Specifications for Tie Trunks	3.3.1.5.15.2
	that Accommodate Registered	10.2.1.6.3
	Terminal Equipment having	
	Facility Interface Codes TL31E	

	and TL32E	
PUB 62200	Group and Super Group Spectrum -	3.3.1.5.2
	Description and Interface	3.3.1.5.2.2
	Specification	10.2.1.6.4
PUB 62310	Digital Data System Channel	3.3.1.5.3
	Interface Specification	3.3.1.5.3.2
		10.2.1.6.5
PUB 62411	High Capacity Digital Service	3.3.1.5.4
	Channel Interface Specification	3.3.1.6.5.2
		10.2.1.6.6
RS-232C	Interface Between Data Terminal	3.2.1.2.5
	(EIA)) Equipment and Data Circuit-	
	Terminating Equipment Employing	
	Serial Binary Data Interchange	
EIA-232D/E	Interface Between Data Terminal	3.2.1.2.5
	Equipment and Data Circuit-	
	Terminating Equipment Employing	
	Serial Binary Data Interchange	
RS-422	Electrical Characteristics (EIA)	3.2.1.2.1.13
	(EIA) of Balanced Voltage Digital	3.2.1.2.1.15
	Interface Circuits	10.2.1.2.1
RS-423	Electrical Characteristics of	3.2.1.2.14
	(EIA) Unbalanced Voltage Digital	3.2.1.2.15
	Interface Circuits	10.2.1.2.1
RS-464	Private Branch Exchange (PBX)	10.2.1.1.2
	(EIA) Switching Equipment for	
	Voice Bank Applications	
RS-470	Telephone Instruments, with Loop	10.2.1.1.3

	(EIA) Signaling, for Voiceband Applications	
RS-496	Interface Between Data Circuit (EIA) Equipment (DCE) and the Public Switched Telephone Network (PSTN)	10.2.1.1.4
EIA-530	High Speed 25-Position Interface for Data Terminal Equipment and Data Circuit-terminating Equipment	3.2.1.2.5 3.2.1.2.15
CCITT V.24	List of Definitions for Interchange Circuits Between Data Terminal Equipment and Data Circuit-Terminating Equipment	3.2.1.2.5
CCITT V.28	Electrical Characteristics for Unbalanced Double-Current Interchange Circuits	3.2.1.2.5
TA-NPL-000342	High-capacity Digital Special Access Service Transmission Parameter Limits and Interface Combinations	3.3.1.5.16 3.3.1.5.16.2
TR-NPL-000334	Voice Grade Special Access Service Transmission Parameter Limits and Interface Combinations	3.3.1.5.5 3.3.1.5.5.2 10.2.1.6.7
TR-NPL-000335	Voice Grade Special Access Service Transmission Parameter Limits and Interface Combinations	3.3.1.5.6 3.3.1.5.6.2 10.2.1.6.8
TR-NPL-000336	Metallic and Telegraph Grade Special Access Service	3.3.1.5.7 10.2.1.6.9

	Transmission Parameter Limits and Interface Combinations	
TR-NPL-000337	Program Audio Special Access	3.3.1.5.8
	Service Transmission Parameter	3.3.1.5.8.2
	Limits and Interface Combinations	10.2.1.6.10
TR-NPL-000338	Television Special Access and	3.3.1.5.9
	Local Channel Services -	3.3.1.5.9.2
	Transmission Parameter Limits and	10.2.1.6.11
	Interface Combinations	
TR-NPL-000339	Wideband Analog Special Access	3.3.1.5.10
	Service Transmission Parameter	3.3.1.5.10.2
	Limits and Interface Combinations	10.2.1.6.12
TR-NPL-000340	Wideband Data Special Access	3.3.1.5.11
	Access Service Transmission	3.3.1.5.11.2
	Parameter limits and Interface Combinations	
TR-NPL-000341	Digital Data Special Access	3.3.1.5.12
	Service Transmission Parameters	10.2.1.6.13
	and Interface Combinations	
TR-NPL-000342	High-capacity Digital Special	10.2.1.6.13
	Access Service Transmission Parameter Limits and Interface Combinations	
TR-TSY-000007	Voice Frequency Network Channel	3.3.1.2.1
	Terminating Equipment - Metallic	3.3.1.2.1.2
	Facilities	10.2.1.3.1
TR-TSY-000009	Asynchronous Digital Multiplexes	3.3.1.4.1
	- Requirements and Objectives	3.3.1.4.1.2

TR-TSY-000475	OTGR:5.0 Network Maintenance:	3.3.1.4.2
	Transport Surveillance	3.3.1.4.2.2
		10.2.1.5.1